



11 o'clock tips

Indirect tax / subsidy P3 questions

Indirect tax questions

- An indirect tax (a tax on goods/ services or on expenditure) can be either a unit (specific) tax (i.e. \$2.00 per unit of the good) or ad valorem (i.e. 23% of the price)
- For P3 purposes, worry only about unit (specific) taxes; ad valorem taxes cannot be part of a calculation exercise (but you need to know what they are and how they are analyzed diagrammatically; more later)
- An indirect tax is analyzed as an additional production cost; as a result, supply of the good decreases and shifts vertically upwards by the amount of the tax¹.
- If the question provides a grid where an initial supply curve is plotted (either as a result of your calculations or because it was given by the question), and you are asked to plot the new supply curve following the imposition of, say, a \$3.00 tax, you just need to draw a new supply *above* the original one, parallel to it and with a vertical distance of 3 units: remember to count 'steps' on the grid and be aware of the 'value' of each step. Use a ruler, a 2B or 3B pencil and be precise.
- If there is no grid and you are asked to make several tax related calculations, everything you need to know is written below.

¹ Remember that the supply curve is nothing but the marginal cost of production: the tax increases the MC and shifts the MC curve upward which implies that supply has now decreased (and, thus the supply curve has shifted left)

- Remember that an indirect tax creates a ‘wedge’ between the price consumers pay (P_c) and the price producers earn (P_p).

- These two are related through the relationship:

$$P_p = (P_c - \text{tax})$$

- After you solve for the original equilibrium price and quantity and you do whatever else you are asked to do (e.g. calculate consumer and/or producer surplus; plot the functions etc.), assume that the question states that a tax equal to ‘t’ dollars per unit is imposed by the government.
- Re-write the demand function but insert P_c as price (since consumers decide on how much to buy based on the price they pay); re-write the supply function also but insert P_p as producers decide on how much they offer based on the price they earn per unit.
- Keep the demand function with P_c in it on the side. Work a bit more on the supply function: re-write it, substituting $(P_c - \text{tax})$ instead of P_p ; collect terms. Solve the system for P_c .
- To find the new equilibrium quantity Q' , plug into the demand function the new equilibrium price P_c you found.
- Go then to the ‘wedge’ equation above and calculate P_p . You’re done.
- Sketch a diagram and plug in the values you’ve found for P_o , Q_o and then for P_c , P_p and Q' .
- Remember that you will find plenty of solved examples and exercises in our S&P volume.
- Note that if the tax is ad valorem then you draw/sketch it above the original supply but it is not anymore parallel: it is steeper as the tax, being a percentage now, is a greater dollar value at each price (10% on a 20 dollar T-shirt is 2 dollars but it is 4 dollars on a 40 dollar T-shirt)

Subsidy questions

- A subsidy is a payment by the government to firms to lower their production costs and thus price and increase production and consumption of the good or service.
- A subsidy decreases the costs of production; as a result, supply of the good increases and shifts vertically downwards by the amount of the subsidy².
- If the question provides a grid where an initial supply curve is plotted (either as a result of your calculations or because it was given by the question), and you are asked to plot the new supply curve following the payment of, say, a \$3.00 subsidy, you just need to draw a new supply below the original one, parallel to it and with a vertical distance of 3 units: remember to count 'steps' on the grid and be aware of the 'value' of each step. Use a ruler, a 2B or 3B pencil and be precise.
- If there is no grid and you are asked to make several subsidy related calculations, everything you need to know is written below.
- Again the price consumers pay is not the same as what producers receive for each unit sold; the producers earn per unit whatever the consumers pay *plus* the subsidy paid by the government;
- Now the 'wedge' equation you will use is:

$$P_p = (P_c + \text{subsidy})$$

- If, for example the subsidy is \$3.00 then plug into the supply function ($P_c + 3$) instead of P_p .
- Solve the system of your demand and (new) supply equations for P_c and solve for P_c .
- Plug this P_c value into the demand function to find Q
- Use the 'wedge' equation above to find P_p . You're done.

² Remember that the supply curve is nothing but the marginal cost of production: the subsidy decreases the MC and shifts the MC curve downward which implies that supply has now increased (and, thus the supply curve has shifted right)

- Sketch a diagram and plug in the values you've found for P_o , Q_o and then for P_c , P_p and Q' .
- Remember that you will find plenty of solved examples and exercises in our S&P volume.

Welfare related calculations in tax / subsidy questions

- Remember that the area representing CS is the area *below the demand curve and above* the price paid by consumers for the units enjoyed.
- Remember that the area representing PS is the area *above the supply curve and below the price earned* (in tax and subsidy questions this is P_p) by producers for the units sold
- Changes in CS and in PS are trapeziums (or, trapezoids).
- In tax problems, the resulting welfare loss is less than the loss in CS and PS because the government collects revenues from the tax; since these may be spent on 'schools' they are not a welfare loss. It follows that the welfare loss is the remaining little triangle (go to our SGuide to revise the topic if you are having problems visualizing this stuff).
- In subsidy problems, there is a welfare loss, even though both the CS and PS enjoyed by consumers and producers respectively, increase; this is because the government needs to finance the subsidy. The welfare loss is thus the little remaining triangle (go to our SGuide to revise the topic if you are having problems visualizing this stuff).
- One last *caveat*: if the tax is a Pigovian tax (to correct the market failures associated with polluting activities or with the consumption of demerit goods like alcohol/tobacco) then the 'little remaining triangle' is a welfare gain as society wants less of these goods to be produced/ consumed; symmetrically, if the subsidy is paid to correct the market failure associated with positive production externalities or the consumption of merit goods (like education/ health services) then the 'little remaining triangle' is a welfare gain as society wants more of these goods to be produced/ consumed.
- Remember you are not [Vladimir Horowitz](#) playing the piano when you key-in data in your GDC; also, neatness pays-off.